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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/944,508	08/30/2001	Warren M. Farnworth	3393.6US (97-324.6)	4342
24247	7590	10/08/2003	EXAMINER	
TRASK BRITT P.O. BOX 2550 SALT LAKE CITY, UT 84110			FULLER, ERIC B	
			ART UNIT	PAPER NUMBER
			1762	
DATE MAILED: 10/08/2003				

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	<b>Application No.</b> 09/944,508	<b>Applicant(s)</b> FARNWORTH, WARREN M.	
	<b>Examiner</b> Eric B Fuller	<b>Art Unit</b> 1762	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 31 July 2003.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-9 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-9 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.  
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. §§ 119 and 120**

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All   b) ☐ Some \* c) ☐ None of:  
1. ☐ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).  
\* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).  
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). _____  |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                           | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) <u>(1)</u> . | 6) <input type="checkbox"/> Other:  |

## DETAILED ACTION

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-3 and 6-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Watts, Jr. et al. (US 6,276,589 B1).

Watts teaches a process where a continuous stream of charged solder droplets is produced (column 3, lines 40-45). Heaters are used to melt the solder in the reserve and maintain it in the liquid state while being ejected (column 3, lines 55-65). A piezoelectric crystal vibrator is used to induce a standing pressure wave on the solder, thus producing droplets (column 3, lines 50-55). When ejected, a charge is selectively applied to the solder droplets (column 4, lines 10-12). A bias is used to deflect some of the droplets in a certain dimension and onto a substrate (column 4, lines 15-30). Additionally, some of the droplets are prevented from reaching the substrate as they are passed undeflected into a gutter. The deflection is programmably controlled (column 4, lines 13-34).

As to claim 1, the reference fails to teach that the deflection occurs in a first and second dimension. However, it is taught in figure 1 that a pair of deflection plates

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(16,18), situated to be perpendicular to the Y-axis, is used to deflect the solder in the Y direction while the substrate is moved in the X direction. One of ordinary skill in the art would recognize, from the teachings of Watt, that the addition of two more deflections plates, that are perpendicular to the X-axis, would allow one to deflect the solder droplets in the X direction as well. This is merely a duplication of parts. It would have been obvious at the time the invention was made to a person having ordinary skill in the art to deflect the solder of Watts in two dimensions as opposed to only one. By doing so, the need for substrate movement may be eliminated, resulting in less energy requirements, and/or the droplet placement is more easily and accurately controlled. Additionally, more areas of the substrate are able to receive solder (as will be discussed in the response to arguments section).

As to claim 2, it is the position of the examiner that the heaters that heat the solder in the supply chamber act to control the temperature of the solder.

As to claim 6, since both the present invention and the reference teach using the apparatus for ejecting solder droplets onto a printed circuit board, and the method of producing the droplets that is taught by the reference is the same as that of the applicant's claim, it is the position of the examiner that the diameter of the solder droplets of the reference would be inclusive of the range that is claimed by the applicant.

As to claim 7, the reference teaches that the desired pattern determines whether the droplets are caught by the gutter (blanked) or allowed to reach the substrate (column 7, lines 40-50). Figure 1 shows horizontal lines being produced, wherein the

absence of solder between the endpoint of the previous horizontal line and the starting point of the next horizontal line shows that it is not desirable to have solder between these two points. Therefore, it would have been obvious to one skilled in the art to blank the solder stream when the stream is positioned between these two points.

As to claim 8, examiner admits that Watts teaches that it is the undeflected droplets that are blanked. However, it is the examiner's position that to allow the droplets to fall undeflected into a gutter that is positioned directly under the stream or to deflect the stream into a gutter that is positioned slightly away from directly under the stream are functionally equivalent to each other, as both act to prevent solder from reaching the substrate. To use either method would have been obvious at the time the invention was made to a person having ordinary skill in the art with a reasonable expectation of success.

Claims 4 and 5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Watts, Jr. et al. (US 6,276,589 B1), as applied to claim 3 above, and further in view of Nakasu et al. (US 6,213,356 B1).

Watts teaches the limitations of claim 3, as shown above, but fails to teach that separate piezoelectric crystals generate the pressure inducing step and the vibration step. Watts does teach to use a piezoelectric crystal for the vibration step (column 3, lines 50-55). Nakasu teaches to use of a piezoelectric crystal when pressurizing a supply of solder in order to increase consistency of the droplets being ejected (column 2, lines 36-61). Therefore, to have a second piezoelectric crystal control the pressure of

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the supply chamber in Watts would have been obvious at the time the invention was made to a person having ordinary skill in the art. By doing so, the consistency of the drop formation is increased. The diameter of the drop is read upon by Watts as shown above with respect to claim 6.

### ***Response to Arguments***

Applicant argues that Watts only teaches deflection on a first dimension and that duplicating the parts to have deflection in a second dimension would not have been obvious. The applicant argues that a modification to the plates exists and therefore is more than just a mere duplication of parts. This argument is not found persuasive. No modification is made to the duplicated plates, only to the location of the plates. To change the location of the duplicated parts is obvious, as the duplicated parts obviously cannot occupy the same space as the original parts. It is noted that the "ribs" of *In re Harza* take up space in different locations than the lone original rib did.

Applicant argues that the prior art does not teach a motivation in having deflection in a second dimension. It is noted that it is not necessary that the prior art suggest explicitly the changes or possible improvements. It is only necessary that "knowledge clearly present in the prior art" be used. See *In re Sernaker* 217 USPQ 1 (Fed. Cir. 1983).

In response to applicant's argument that the examiner's conclusion of obviousness is based upon improper hindsight reasoning, it must be recognized that any judgment on obviousness is in a sense necessarily a reconstruction based upon

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hindsight reasoning. But so long as it takes into account only knowledge which was within the level of ordinary skill at the time the claimed invention was made, and does not include knowledge gleaned only from the applicant's disclosure, such a reconstruction is proper. See *In re McLaughlin*, 443 F.2d 1392, 170 USPQ 209 (CCPA 1971).

The examiner notes that one of ordinary skill in the art would at least possess the knowledge and education of a design engineer, such as at least a bachelor's degree in engineering that included courses in electromagnetism, particle dynamics, and fluid dynamics. *Mueller Brass Co. v. Reading Industries* 176 USPQ 361,369, teaches that ordinary skill in the art is the level of skill of those who normally attack the problems of the art that counts. Persons who do most of the problem solving in involved art are graduate engineers, and as such they are chargeable with the general knowledge concerning principals of engineering, outside the narrow field involved, and with skills, ingenuity, and competence of an average professional engineer.

From looking at Watts, one of ordinary skill in the art easily recognizes that points below the gutter, and points that lie on the same line as the gutter in the X-direction, cannot be coated with solder. This is an obvious deficiency to the invention taught by Watts that one of ordinary skill in the art would be able to recognize without the need of the applicant's disclosure. Just as Watts uses deflection to increase the coat-able areas of the substrate in the Y-direction, one of ordinary skill would recognize that this same fundamental teaching, applied to the X-direction, would receive the same benefits of increasing the coat-able areas of the substrate in the X-direction.

This obvious modification in order to reach areas of the substrate that are otherwise not coat-able was brought up in the previous office action and the applicant has not argued the validity of this interpretation. This obvious benefit is independent from the other obvious benefit of eliminating substrate movement.

In a separate train of thought, Watts clearly provides a teaching that a pair of deflection plates, arranged perpendicularly to the Y-axis, provides deflection in the Y-axis. Just as one pair of plates is used to control drop placement in a certain axis, one having the ordinary knowledge and ingenuity of an engineer would recognize that additional pairs of plates would allow for greater control of drop placement. From the teaching of plates arranged on the Y-axis providing deflection in the Y direction, an ordinary engineer would have the capacity to expand this to an additional pair of plates arranged on a different axis to provide displacement on that axis.

The motivation doing so is that that deflection in two directions would eliminate the need for substrate movement. One of ordinary skill would recognize that it requires less energy to displace lighter objects, such as a solder droplet, than to move a much heavier object, such as the substrate. This concept of lighter objects requiring less energy to move than heavier objects (moving the droplet versus moving the substrate) is well within the scope of knowledge of a graduate engineer without the use of the applicant's specification and is the basis for why eliminating substrate movement is a benefit. Therefore, elimination of substrate movement, in order to use less energy, is sufficient motivation for one skilled in the art to have droplet deflection in two directions.



Watts teaches all the limitations of the applicant's independent claim, absent providing deflection in two dimensions. Regardless if substrate movement is eliminated or not, one with the knowledge of an engineer would recognize that as one pair of plates increases control of the process over no plates, multiple pairs of plates would allow for more control than a single pair of plates. To have multiple pairs of plates would therefore have been obvious to one of skill in the art in order to reap the benefit of increased placement control.

Applicant argues the function equivalents argument with respect to claim 8. This argument is not found convincing. The reference teaches blanking undeflected solder droplets and depositing deflected droplets. The present invention blanks deflected solder droplets. This is because the gutter is not located in a location directly under the solder outlet. However, location of the gutter is not critical. One of ordinary skill would understand that in order to blank the solder, it must reach the gutter, wherever the gutter is placed.

### ***Conclusion***

**THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within

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TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Eric B Fuller whose telephone number is (703) 308-6544. The examiner can normally be reached on Mondays through Thursdays.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Shrive Beck, can be reached at (703) 308-2333. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.



EBF



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